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(72) Inventor(s): Jui-Chien Kao		(58) Field of Search: UK CL (Edition W ) B8C, G5C INT CL <sup>7</sup> A47F, B65D Other: JAPIO, WPI, EPODOC
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(54) Abstract Title: Tool suspension device having a separable tool bracket with offset parting line and an injection mould assembly for making the bracket

(57) A tool suspension device comprises a suspension board and a tool bracket 10 mounted thereon. The bracket 10 comprises a U shaped body having a longitudinal tool slot 103 defined from the top to the bottom. A continuous parting line 102 is formed around the top, bottom and sides and a product indicator 101 is moulded on the front of the U shaped body. A mould for making the bracket is also disclosed. The mould comprises an injection mould assembly which comprises a lower part 61 having at least one core 611, an upper part 20 demountably mounted on the top of the lower part and comprising a common mould 200. The common mould 200 has at least one through cavity 201 that has a primary flat moulding surface. The upper part 20 includes an interchangeable mould 202 and has upper cavities 203 aligned with the through cavity 201. Each upper cavity 203 has a bottom, a marking portion 204 formed on the bottom and a secondary flat moulding surface flush with the primary flat moulding surface to mould the tool bracket 10 with an offset parting line 102.

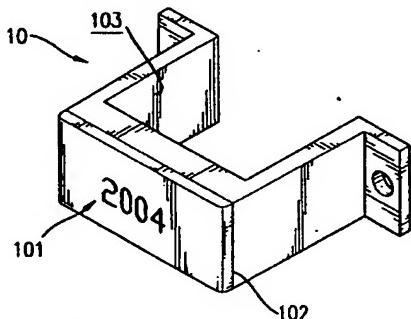


FIG. 2

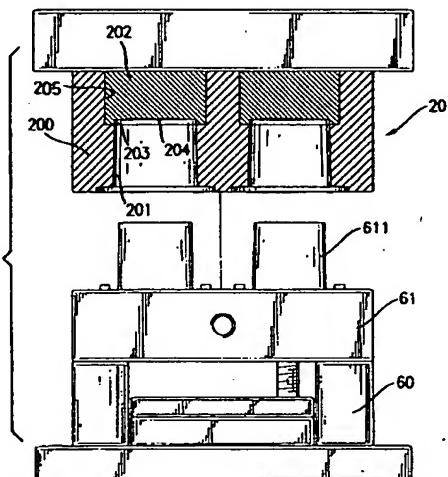


FIG. 3

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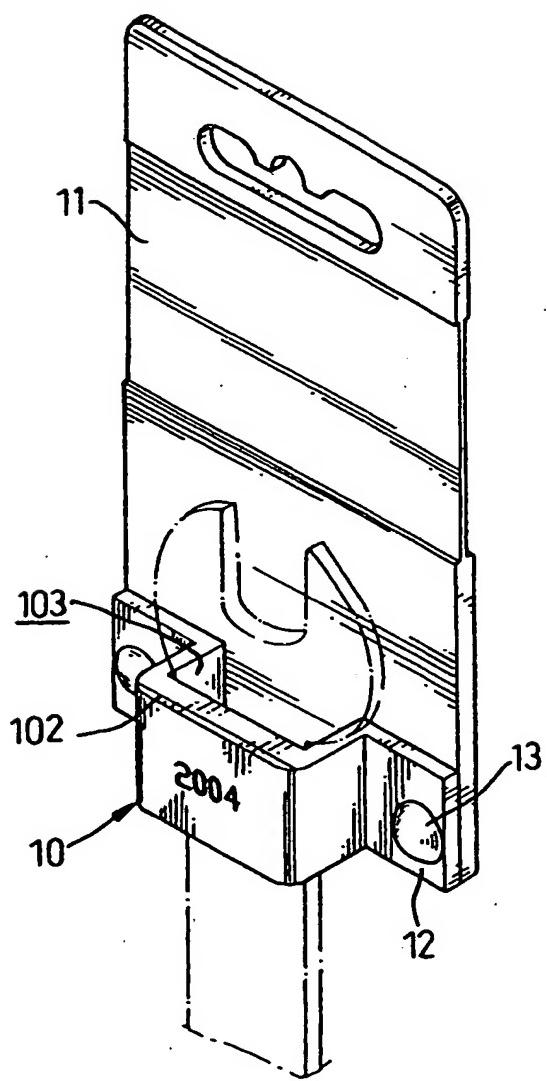
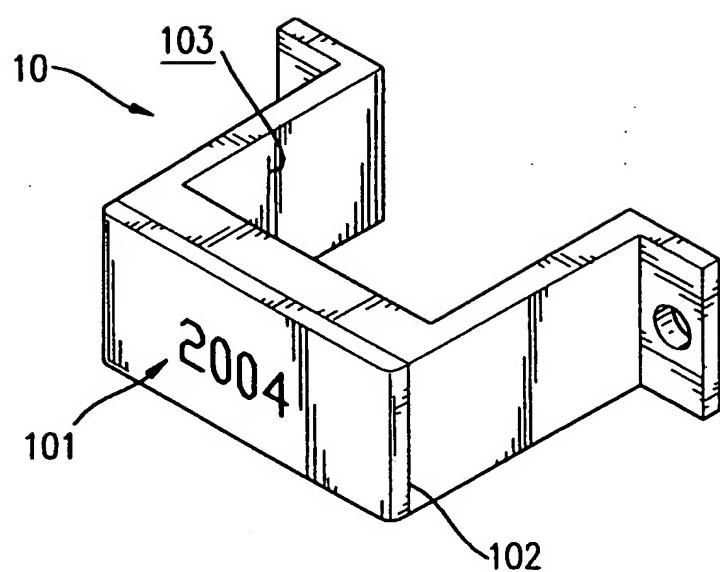


FIG. 1



**FIG. 2**

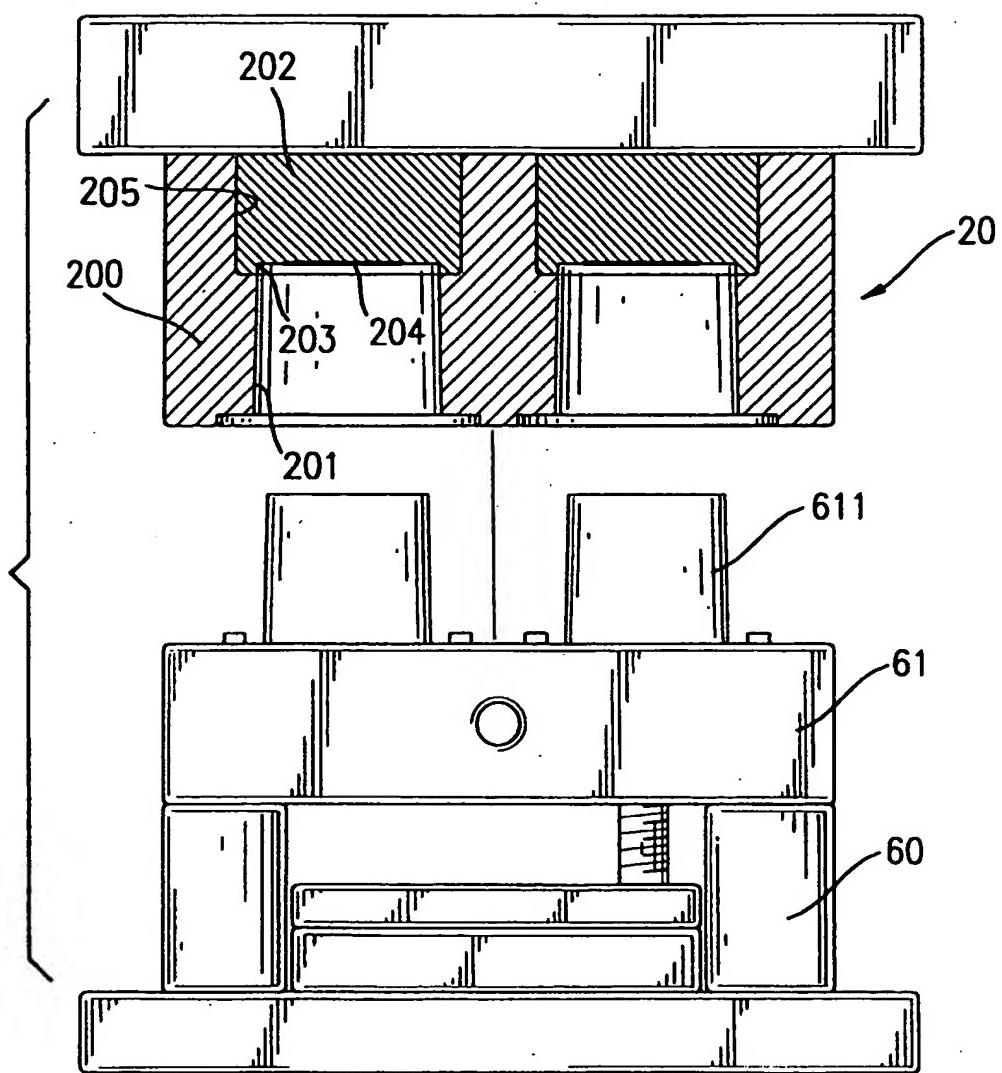


FIG. 3

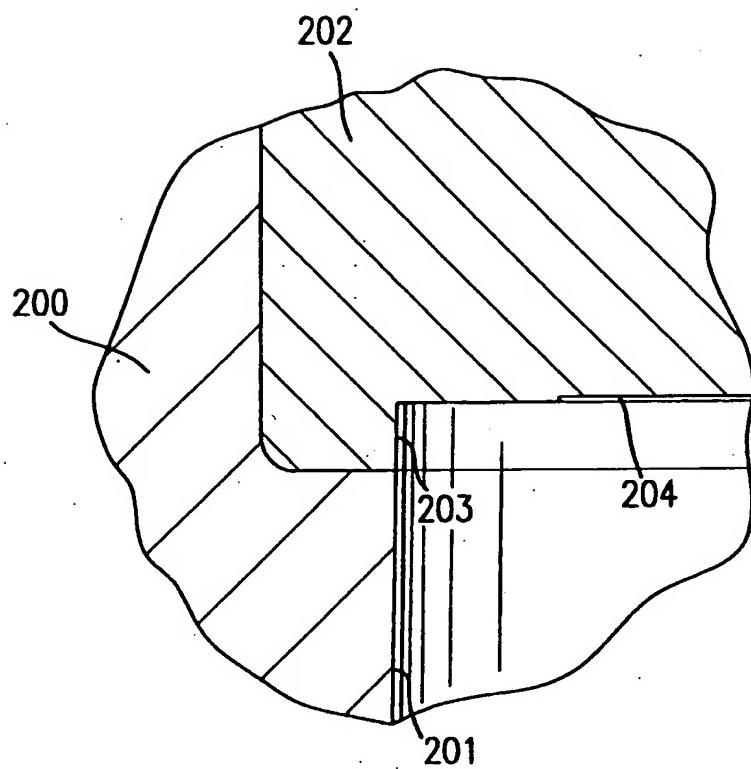


FIG. 4

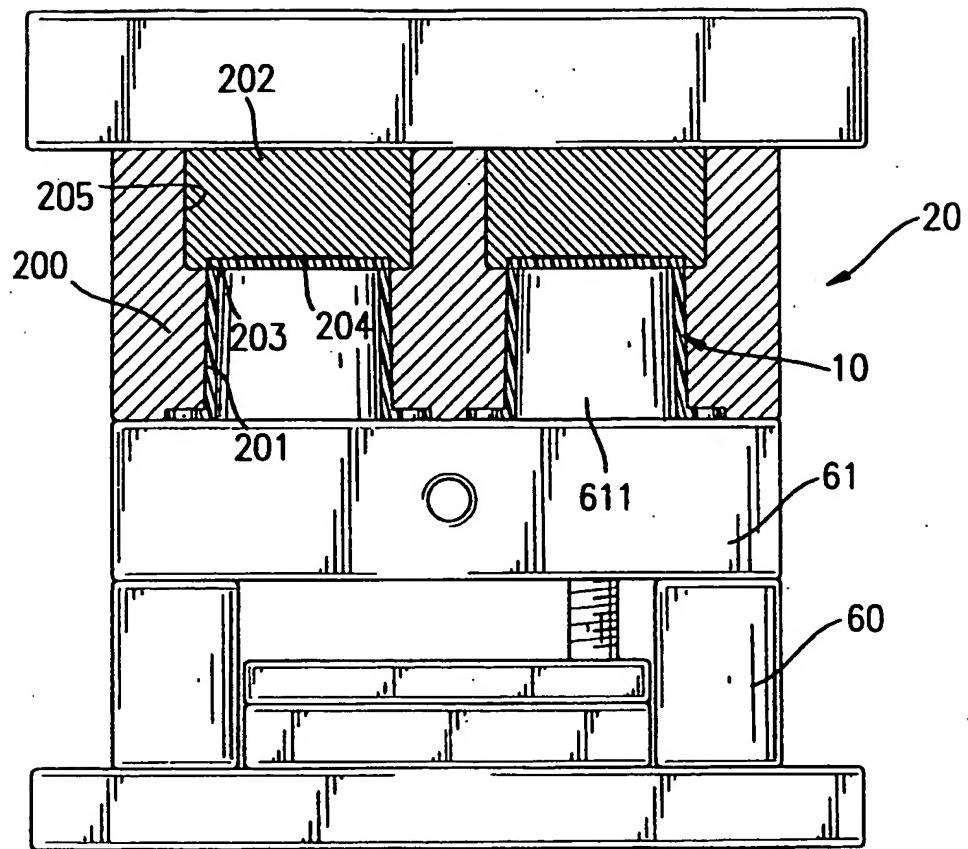
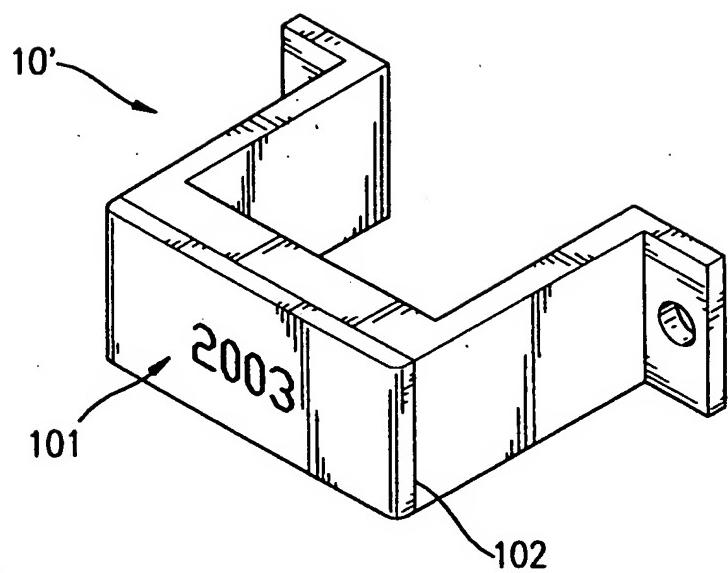


FIG. 5



**FIG. 6**

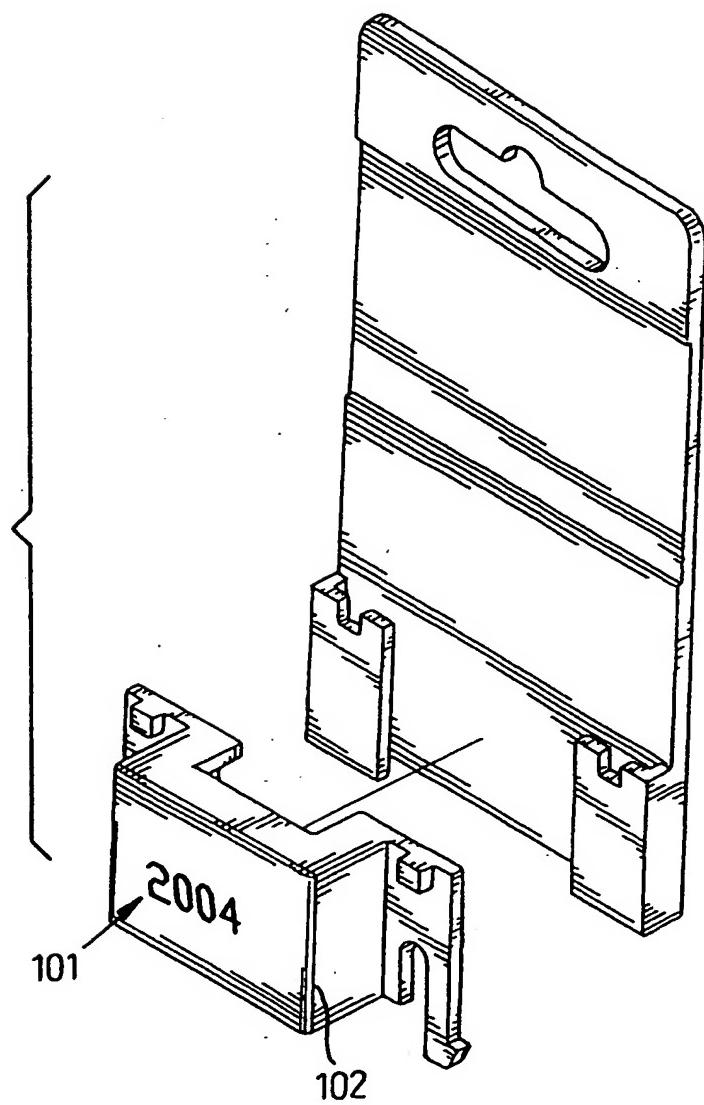


FIG. 7

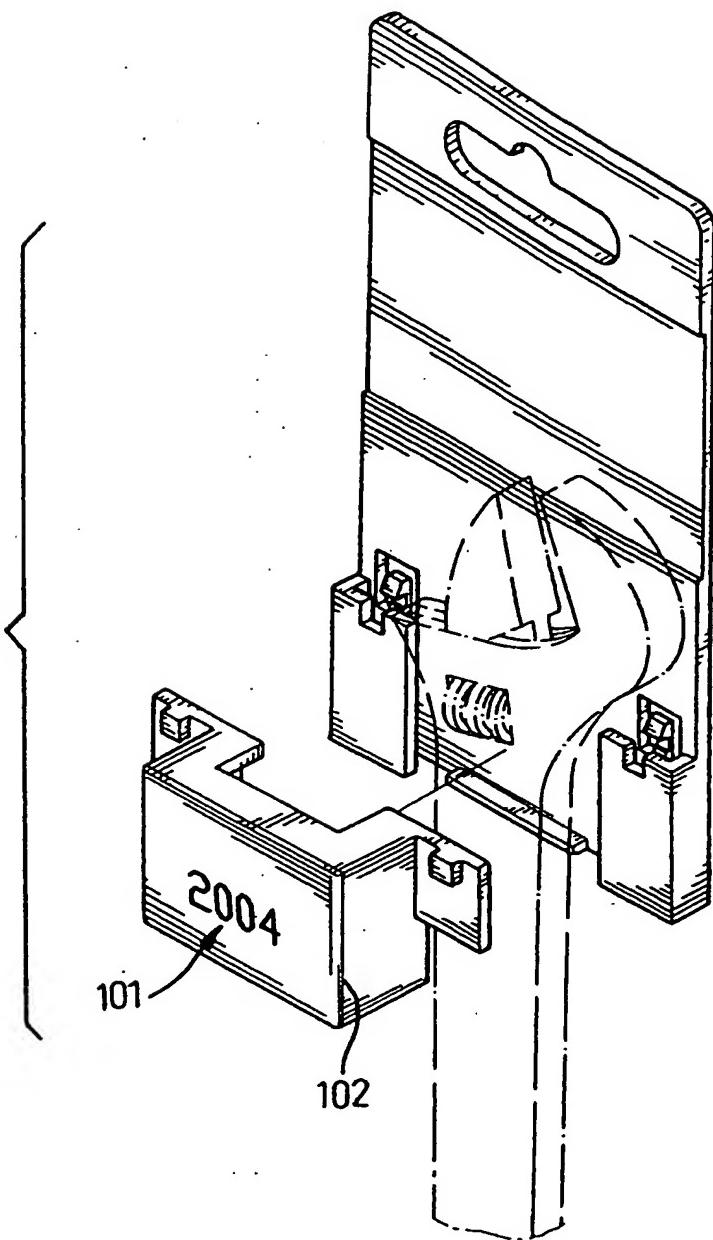
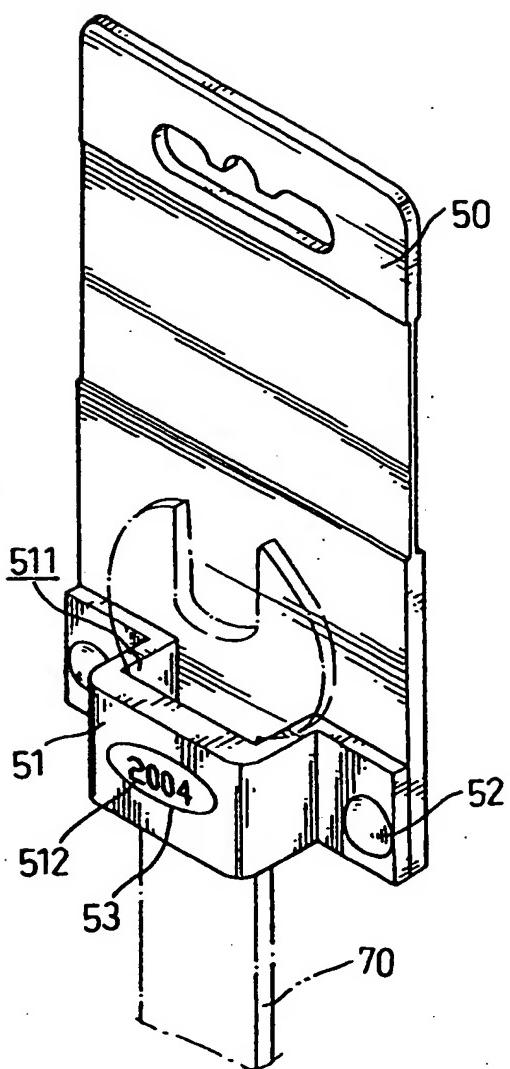
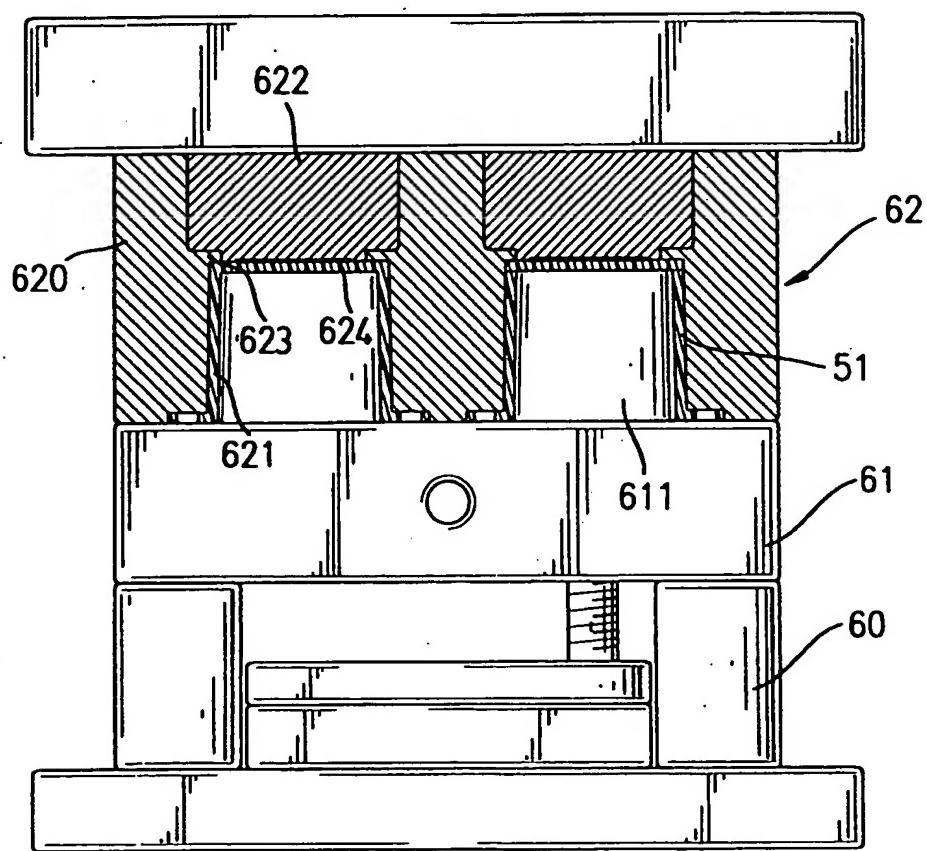


FIG. 8



**FIG. 9**  
PRIOR ART



**FIG. 10**  
PRIOR ART

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**TOOL SUSPENSION DEVICE HAVING A SEPARABLE TOOL  
BRACKET WITH OFFSET PARTING LINE AND A PLASTIC  
INJECTION MOLD ASSEMBLY FOR MAKING THE TOOL BRACKET**

**1. Field of the Invention**

The present invention relates to a tool suspension device, and more particularly to a tool suspension device having a separable tool bracket with offset parting lines, and a plastic injection mold assembly for making the tool bracket.

**2. Description of Related Art**

With reference to Fig. 9, a conventional tool suspension device in accordance with prior art comprises a suspension board (50), a tool bracket (51) and fasteners (52). The suspension board (50) has a front (not numbered) and a bottom (not numbered). The tool bracket (51) is mounted detachably on the front of the suspension board (50) at the bottom and comprises a U-shaped body (not numbered) and two mounting feet (not numbered). The body has a longitudinal tool slot (511), a front (not numbered) and two opposite sides (not numbered). The mounting feet are formed respectively on and protrude respectively from the sides of the body. The fasteners (52) are attached respectively to the mounting feet to fasten the tool bracket (51) on the front of the suspension board (50). Therefore, a tool, such as a wrench (70) can be inserted into and held in the tool slot (511) for suspension.

Both the suspension board (50) and tool bracket (51) are made by plastic injection molding. The suspension board (50) and tool bracket (51) need separate mold sets. For custom specialty products, the front of the body of the tool bracket (51) is molded with a product indicator (512), such as trademarks, significant

symbols, characters, etc. to provide relevant product information about the tool suspension device.

With reference to Figs. 9 and 10, a plastic injection mold assembly (not numbered) in accordance with the prior art to make the tool bracket (51) with the front product indicator (512) is mounted on a mold base (60) and comprises a lower part (61) and an upper part (62). The lower part (61) is mounted on the mold base (60) and has a top (not numbered) and multiple cores (611) formed on the top. The cores (611) are arranged along two straight lines.

The upper part (62) is mounted detachably on the top of the lower part (61) and comprises a common mold (620) and two interchangeable molds (622). The common mold (620) has a top (not numbered), a bottom (not numbered), two channels (not numbered) and multiple cavities (621). The cavities (621) are defined in the bottom of the common mold (620) and correspond respectively to the cores (611). Each pair of corresponding cavity (621) and core (611) fabricates a tool bracket (51). The channels are defined in the top of the common mold (620) and are aligned respectively with the in-line cavities (621). Each of the cavities (621) has a bottom (not numbered), a molding surface (not numbered) and an opening (not numbered). The molding surface is used to shape the body of the tool bracket (51). The opening is defined through the bottom so that the cavities (621) communicate respectively with the channels.

The interchangeable molds (622) are mounted respectively in the channels and have multiple bottom protrusions (not numbered). The bottom protrusions are respectively fitted and held in the openings of the cavities (621) and have respectively a parting surface (not numbered) flush with the bottom of

the adjacent cavity (621). To make the product indicator (512) such as a string of Arabic numerals on the front of the body of the tool bracket (51) (e.g. 2004 shown in Fig. 9), each parting surface has a marking portion (624) to mold the product indicator (512) on the front of the body of the tool bracket (51). The marking portion (624) may be indentations to form a solid product indicator (512) or protrusions to form an indented product indicator (512).

Therefore, when the contents of the product indicator (512) needs to be changed, only the interchangeable mold (622) has to be replaced with a new one, which will save cost of the mold assembly.

However, the described mold assembly causes a parting line (53) around the product indicator (512) on the front of the body of the tool bracket (51). The parting line (53) is formed during the injection molding along the interface of the opening in the bottom of each cavity (621). Improper location of the parting line (53) on the front of the body of the tool bracket (51) will effect the appearance of the tool bracket (51) and cause the front of the tool bracket (51) to be untidy. Therefore, the whole tool suspension device becomes unsightly.

In addition, defining the opening in the bottom of each of the cavities (621) forms an annular protrusion (623) that protrudes into the molding surface of the cavity (621). The annular protrusions (623) will restrict machining means for defining the cavities (621) in the common mold (620). Electric discharge machining (EDM) is the only way to define the cavities (621) except wire-cut electric discharge machining. Wire-cut machining cannot be used because of the annular protrusions (623). Electric discharge machining requires more time and cost to define the cavities (621) than wire cutting machining does.

To overcome the shortcomings, the present invention provides an improved plastic injection mold assembly to make a separatable tool bracket with offset parting lines to mitigate or obviate the aforementioned problems.

The main objective of the invention is to provide a tool suspension device that has a separatable tool bracket with offset parting lines to make a front of the tool bracket clean and neat.

Another objective of the present invention is to provide a plastic injection mold assembly for making a tool bracket with offset parting lines where the injection mold assembly comprises a common mold and multiple interchangeable molds to reduce mold costs.

A mold assembly for making a tool bracket for a tool suspension device includes a lower part and an upper part. The lower part has multiple cores. The upper part is mounted detachably on the lower part and includes a common mold and multiple interchangeable molds. The common mold has multiple cavities corresponding respectively to the cores to simultaneously mold multiple tool brackets. Each of the cavities has a primary flat molding surface. The interchangeable molds are mounted detachably in the common mold and have multiple upper cavities aligned and communicating respectively with the cavities in the common mold. Each of the upper cavities has a bottom, a marking portion formed on the bottom and a secondary flat molding surface flush with the primary flat molding surface of the aligned cavity. Consequently, a tool bracket molded by the mold assembly has a front product indicator and an offset parting line to make a front of the tool bracket clean.

Other objectives, advantages and novel features of the invention will

become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

**IN THE DRAWINGS**

**Fig. 1** is an operational perspective view of a tool suspension device in accordance with the present invention;

**Fig. 2** is a perspective view of a tool bracket of the tool suspension device in Fig. 1;

**Fig. 3** is a side plan view in partial section of a mold assembly to make tool brackets in Fig. 2;

**Fig. 4** is an enlarged cross sectional side plan view of a segment of an upper part of the mold assembly in Fig.3;

**Fig. 5** is an operational side plan view in partial section of the mold assembly in Fig. 3 molding multiple tool brackets in Fig. 2;

**Fig. 6** is a perspective view of an alternative embodiment of the tool bracket in accordance with the present invention;

**Fig. 7** is an exploded perspective view of a second embodiment of the tool suspension device in accordance with the present invention;

**Fig. 8** is an exploded perspective view of a third embodiment of the tool suspension device in accordance with the present invention;

**Fig. 9** is a perspective view of a conventional tool suspension device in accordance with the prior art; and

**Fig. 10** is an operational side plan view in partial section of a conventional mold assembly in accordance with the prior art for making the tool bracket in Fig. 9.

With reference to Figs. 1 and 2, a tool suspension device in accordance with the present invention comprises a suspension board (11), a tool bracket (10) and multiple fasteners (13). The suspension board (11) has a front (not numbered). The tool bracket (10) is attached demountably to the front of the suspension board (11) with the fasteners (13) and comprises a U-shaped body (not numbered) and two mounting feet (12). The body has a longitudinal tool slot (103), a front (not numbered), a top (not numbered), a bottom (not shown) and two opposite sides (not numbered). The tool slot (103) is defined from the top to the bottom to hold a tool, such as a wrench (not numbered). The mounting feet (12) extend respectively from the sides of the body to mount the tool bracket (10) on the front of the suspension board (11) with the fasteners (13).

With reference to Figs. 2 and 6, the tool bracket (10) has a product indicator (101) formed on the front of the body to provide some relevant product information about the tool suspension device. The product indicator (101) may be a trademark, company logo, useful characteristic, significant symbol, etc. and is molded on the front of the body of the tool bracket (10). For illustrative purposes only, the product indicator (101) on the tool bracket (10) in Figs. 1 and 2 is 2004, and the product indicator (101) on the tool bracket (10') in Fig. 6 is 2003. The tool brackets (10, 10') have respectively individual product indicators (101) to make them distinct from each other. Therefore, the tool suspension device may use different types of tool bracket (10, 10') for customer specialty products.

With further reference to Figs. 3, 4 and 5, a plastic injection mold assembly (not numbered) for making the tool bracket (10) is mounted on a mold

base (60) and comprises a lower part (61) and an upper part (20). The lower part (61) is mounted on the mold base (60) and has a top (not numbered) and multiple cores (611) formed on the top. The cores (611) are arranged in two straight lines. Each of the cores (611) is used to fabricate one tool bracket (10) so that the mold assembly forms simultaneously multiple tool brackets (51) at a time to improve efficiency. The quantity of the core (611) may be one, which means the mold assembly only forms one tool bracket (51) at a time.

The upper part (20) is mounted demountably on the top of the lower part (60) and comprises a common mold (200) and multiple interchangeable molds (202). The common mold (200) has a top (not numbered), a bottom (not numbered), multiple through cavities (201) and two channels (205). Each of the through cavities (201) is defined in the bottom of the common mold (200) and has a primary flat molding surface (not numbered). The through cavities (201) are arranged in two straight lines and correspond respectively to the in-line cores (611). An amount of the through cavities (201) corresponds to the amount of the cores (611). The channels (205) are defined in the top of the common mold (200) and are respectively aligned and communicated with the in-line through cavities (201).

The interchangeable molds (202) are mounted respectively in the channels (205) in the common mold (200), and each interchangeable mold (202) has a bottom (not numbered) and multiple upper cavities (203). The upper cavities (203) are defined in the bottom of the interchangeable molds (202) and are respectively aligned with the corresponding through cavities (201). Each of the upper cavities (203) communicates with the aligned through cavity (201) in

the common mold (200) and has a secondary flat molding surface (not numbered), a bottom (not numbered) and a marking portion (204). The secondary flat molding surface is flush with the primary flat molding surface of the through cavity (201) to avoid protrusions relative to the primary flat molding surface of the through cavity (201). The primary and the secondary flat molding surfaces are used to shape the body of the tool bracket (10) during the injection molding. The design of the primary flat molding surface of the through cavity (201) permits using wire-cutting machining to define the through cavities (201). Using wire-cutting machining is more effective and faster than electronic discharge machining to define the through cavities (201).

With reference to Figs. 2 and 5, the marking portion (204) is formed on the bottom of the upper cavity (203) to mold the product indicator (101) on the front of the body of the tool bracket (10). Since the secondary flat molding surface of the upper cavity (203) is flush with the primary flat molding surface of the through cavity (201), a continuous parting line (102) is formed along the interface between the interchangeable mold (202) and the common mold (200) on the top, the bottom and the sides of the body of the tool bracket (10). Consequently, the parting line (102) is not visible when a consumer faces the front of the tool suspension device. Therefore, the front of the body of the tool bracket (10) is clean and neat.

With reference to Figs. 1, 3 and 6, making the tool brackets (10, 10') with different product indicators (101) only requires that the interchangeable molds (202) be replaced. Always using the common mold (200) of the upper part (20) of the mold assembly reduces the overall upper part (20) cost. The depth of the

upper cavity (203) in the interchangeable mold (202) is not deep so only a short time is required for the electronic discharge machining to define the upper cavity (203).

With reference to Figs. 7 and 8, the tool suspension device in accordance with the present invention may comprise different types of tool brackets that are fastened respectively by different attaching means.

Even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size, and arrangement of parts within the scope of the appended claims.

**CLAIMS:**

1. A tool suspension device comprising:
  - a suspension board (11) having a front; and
  - a tool bracket (10) mounted demountably on the front of the suspension board (11) and having
    - a U-shaped body having a top, a bottom, two opposite sides, a front, a longitudinal tool slot (103) defined from the top to the bottom and a continuous parting line (102) formed around the top, the bottom and the sides;
    - and
    - a product indicator (101) molded on the front of the U-shaped body.
2. A plastic injection mold assembly for making the tool bracket (10) as claimed in claim 1, and the mold assembly comprising
  - a lower part (61) having a top and at least one core (611) protruding from the top;
  - an upper part (20) demountably mounted on the top of the lower part (61) and comprising
    - a common mold (200) with a top and a bottom having
      - at least one through cavity (201) aligned with one of the at least one core (611) defined in the bottom of the common mold (200) and each of the at least one through cavity (201) having a primary flat molding surface; and
      - at least one channel (205) defined in the top of the common mold (200) and communicating with the at least one through cavity (201); and
    - an interchangeable mold (202) demountably mounted in each of the at least one channel (205) and having a bottom and at least one upper cavity (203)

defined in the bottom of the interchangeable mold (202), and each one of the at least one upper cavity (203) aligned and communicating with one of the at least one through cavity (201) in the common mold (200) and having a bottom, a marking portion (204) formed on the bottom of the upper cavity (203) and a secondary flat molding surface flush with the primary flat molding surface in the aligned through cavity (201) to shape a body of the tool bracket (10).

3. The plastic injection mold assembly as claimed in claim 2, wherein the at least one core (611) is implemented with multiple cores (611) that are arranged into two straight lines;

the at least one through cavity (201) is implemented with multiple through cavities (201) that are respectively aligned with the multiple cores (611); and

the at least one channel (205) is implemented with two channels (205) that communicate respectively the in-line through cavities (201).



Application No: GB0401200.1

Examiner: Hayley Yates

Claims searched: 1

Date of search: 12 July 2004

## Patents Act 1977: Search Report under Section 17

### Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular reference
A	1	US6193200 A Kao; see figure 1
A	1	US6164463 A Lee; see figure 1
A	1	US5819932 A Norbits; see figure 1
A	1	EP0249244 A Groten; see figure 1
A	1	US5855274 A Piao; see figure 2
A	1	DE3807208 A Holland; see figure 2

### Categories:

X Document indicating lack of novelty or inventive step	A Document indicating technological background and/or state of the art.
Y Document indicating lack of inventive step if combined with one or more other documents of same category	P Document published on or after the declared priority date but before the filing date of this invention
& Member of the same patent family	E Patent document published on or after, but with priority date earlier than, the filing date of this application

### Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC<sup>W</sup>:

B8C; G5C

Worldwide search of patent documents classified in the following areas of the IPC<sup>07</sup>

A47F; B65D

The following online and other databases have been used in the preparation of this search report

JAPIO, WPI, EPODOC